

Appl. No. 09/743,644

Reply to Office Action of March 31, 2003

REMARKS

The final Office Action was issued on pending claims 1-5 and 7-12. Claims 2-4 and 9 have been withdrawn from consideration. Claims 1, 5, 7, 8 and 10-12 stand rejected. In this Response, claim 1 has been amended and no claims have been added or cancelled. Thus, claims 1-5 and 7-12 are pending in the application, and claims 1, 5, 7, 8 and 10-12 are under consideration.

Applicants kindly request an interview with the Examiner.

Drawings and Specification

On pages 2 and 3 of the Office Action, the drawings and Specification were objected to for informalities. As to the drawing objections, the specification will be amended to include reference number 7. A substitute specification was required before the application passes to issue. A substitute specification is being prepared to correct the informalities. The substitute specification will be submitted prior to issuance of the application.

Claim Rejections – 35 USC § 103

At pages 4-10 of the Office Action, rejections under 35 USC § 103(a) were entered. Claims 1, 5, 7 and 10-12 were rejected under 35 USC § 103(a) as being unpatentable over Canon (JP 63-255373) in view of Hitomi et al. (JP 3-158469) and Takahiro et al. (JP 63-286579). Claim 8 was rejected under 35 USC § 103(a) as being unpatentable over Canon in view of Hitomi et al. and Takahiro et al., and further in view of Collison et al. (US 6,203,657). Claims 1, 5, 7 and 10-12 were rejected under 35 USC § 103(a) as being unpatentable over Zarowin et al. (US 5,290,382) in view of Hitomi et al. and Takahiro et al. Claim 8 was rejected under 35 USC § 103(a) as being unpatentable over Zarowin et al. in view of Hitomi et al. and Takahiro et al., and further in view of Collison et al. Applicants respectfully disagree.

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Applicants' invention, as claimed in claim 1, pertains to a surface treatment apparatus for generating plasma by plasma generating electrodes in a casing having plasma generating electrodes, a raw-gas inlet and a substrate supporting table, plasma ionizing the raw gas and plasma processing a surface of said substrate, which is mounted on said substrate supporting table. Claim 1 has been amended to clarify the claim. Claim 1 now calls for "the electrodes, which are disposed so as to interpose a plasma flow spurting out from the plasma vent therebetween for not disturbing the plasma flow, are provided in and between the vicinity of said plasma vent and the vicinity of said plasma supporting table."

Applicants' invention, as claimed in claim 1, is distinguished from Hitomi et al. and Takahiro et al. Applicants' present invention has a plasma vent. However, neither Hitomi et al. nor Takahiro et al. have a plasma vent. Accordingly, film formation according to Hitomi et al. and Takahiro et al. is slower than film formation according to the present invention.

Furthermore, in Hitomi et al. and Takahiro et al., an electrode is disposed so as to disturb the plasma flow to the substrate, which decreases film formation speed further. On the other hand, in the present invention, electrodes are disposed so as to interpose the plasma flow spurted out from the plasma vent therebetween for not disturbing the plasma flow and do not exist in the path of the plasma flow to a substrate. Due to the plasma vent and disposition of the electrodes, the present invention enables to remarkably increase the film formation speed compared with Hitomi et al. and Takahiro et al.

Even further, the electrodes, which excludes charge particles, of the present invention is significantly different from the electrodes of Hitomi et al. and Takahiro et al.

As to Hitomi et al., Hitomi et al. uses neutral active species for film formation generated by electrically neutralizing the charged particles by colliding the particles against the electrode.

On the other hand, in the present invention, the electrodes are disposed outside of the plasma flow as mentioned above. When voltage is applied to the electrodes, an electric potential difference is created and it captures the charged particles. For example, when minus voltage is applied, the plus charged particles are captured and vice versa. At the same time, the charged particles having the same electric potential as that of the applied voltage that are not captured by

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the electric potential difference are forced to change their directions and are excluded from the plasma flow by repulsive force.

As to Takahiro et al, the charged particles are captured by the electric potential difference. However, the electrode of the Takahiro et al. is a mesh-shaped sheet and disposed in the middle of the plasma flow. These features are not capable of excluding the charged particles by repulsive force. Again, the electrodes of the present invention can exclude charged particles by repulsive force and are significantly different from Takahiro et al.

Even further, Applicants respectfully submit that the combinations of the Hitomi et al. and Takahiro et al. with Canon, Zarowin et al. and Collison et al. do not result in Applicants' claimed invention, even if such combinations are proper.

The Office Action asserts that Hitomi et al. and Takahiro et al. are properly combinable with Canon, Collison et al. and Zarowin et al. (having two divided chambers and a plasma vent) such that Canon, Collison et al. and Zarowin et al. are modified to result in the present invention. However, in the case of applying the electrode of Hitomi et al. and Takahiro et al. to Canon, Collison et al. and Zarowin et al., the electrode is disposed under the plasma vent and disturbs the plasma flow, which results in slow film formation.

Moreover, the combinations of Hitomi et al. and Takahiro et al. with Canon, Collison et al. and Zarowin et al. do not provide the same features as that of the present invention because the features of Hitomi et al. and Takahiro et al. for excluding the charged particles are different from that of the present invention, as previously mentioned above.

Thus, Applicants respectfully submit that the § 103(a) rejection of claims 1-3 has been overcome.

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CONCLUSION

For the foregoing reasons, Applicants submit that the patent application is in condition for allowance and request a Notice of Allowance be issued.

The Commissioner is authorized to charge and credit Deposit Account No. 02-1818 for any fees associated with the submission of this Response to Office Action.

Respectfully submitted,

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